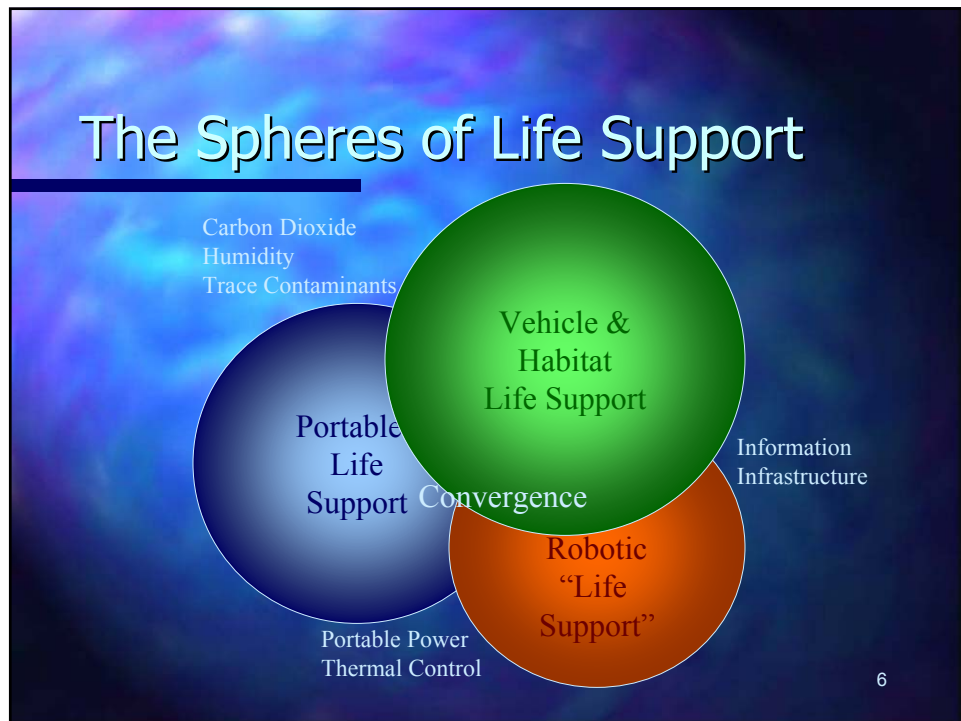
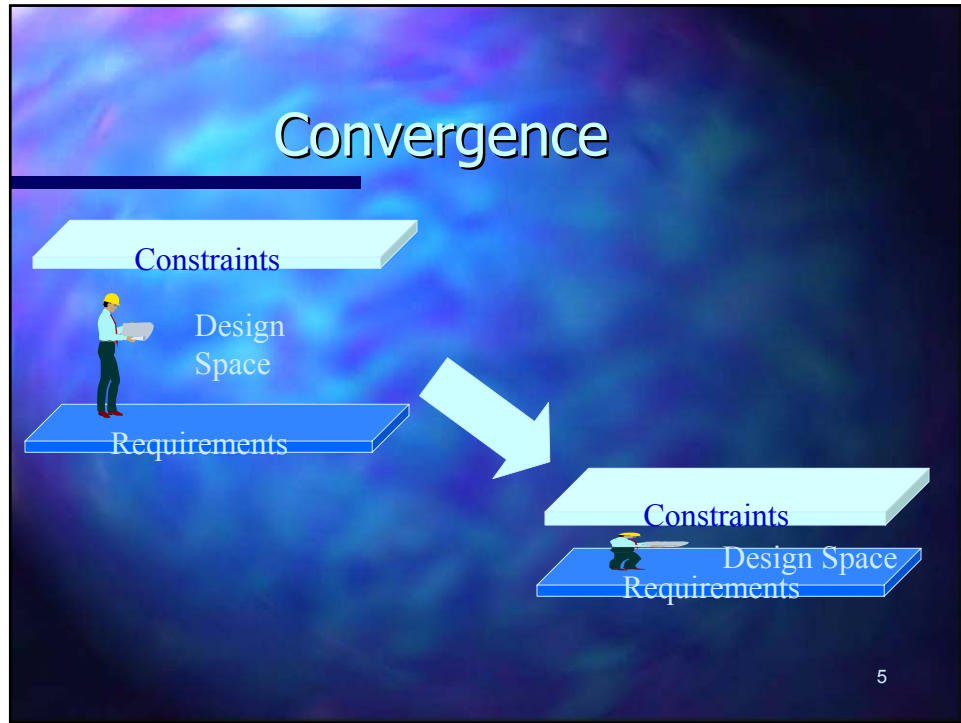
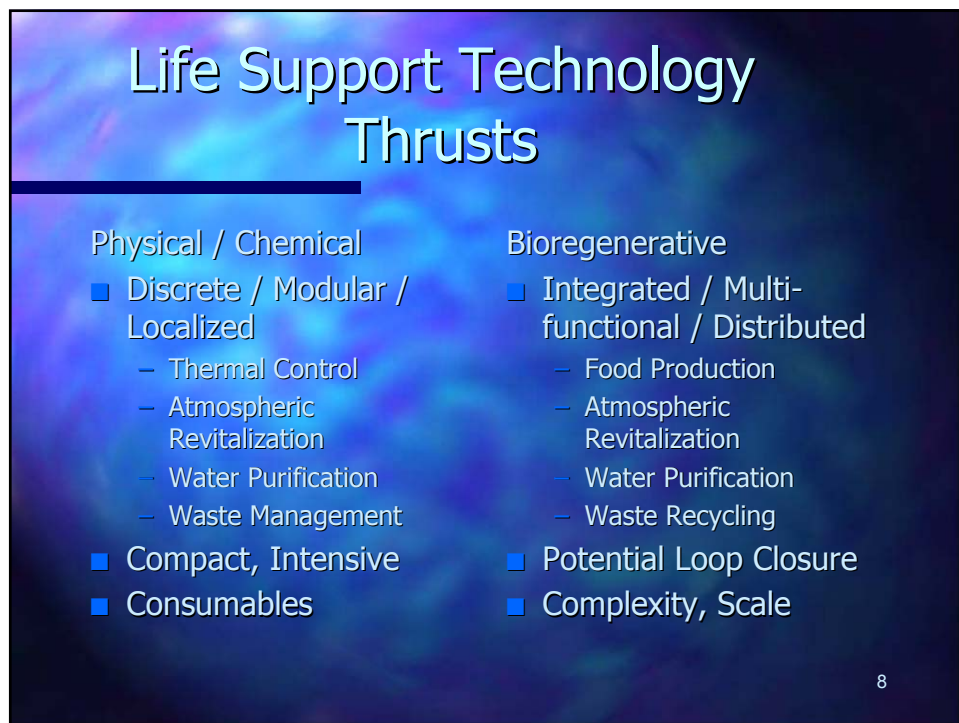
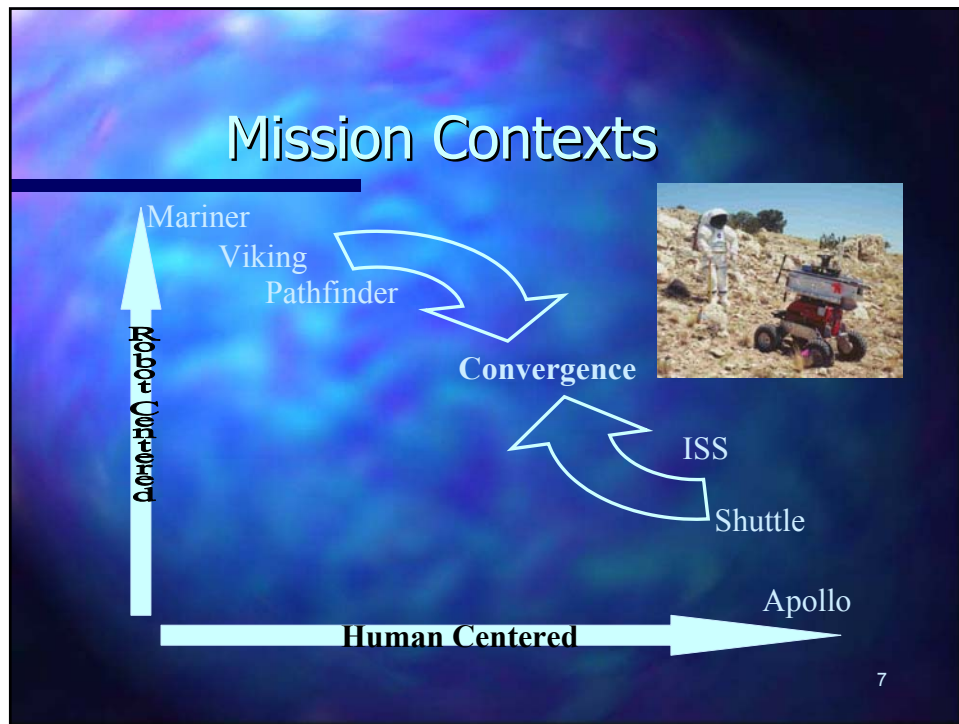


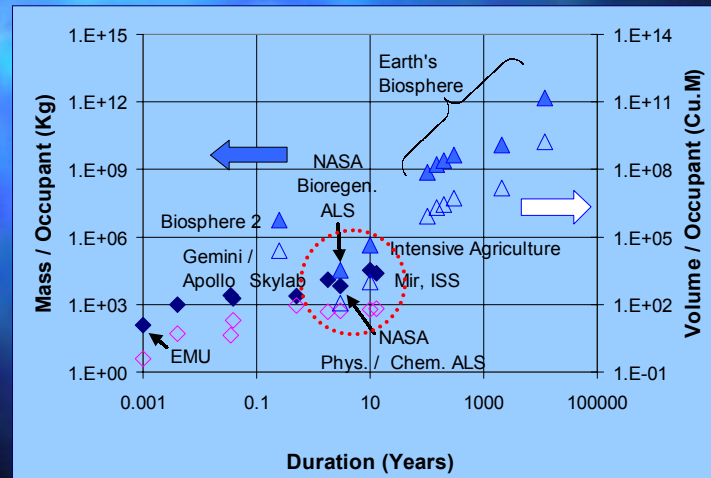
The Future For Life Support

- Longer Missions, Farther From Home Will Demand:
- More Life Support Functions
 - Delivered in a More Earth Like Manner
- Reduced Mass and Volume
- Reduced Expendables
- Reduced Operational Burden
- Increased Reliability





Life Support Technology Convergence



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Life Support Technology Development Evolution

Personal Life support

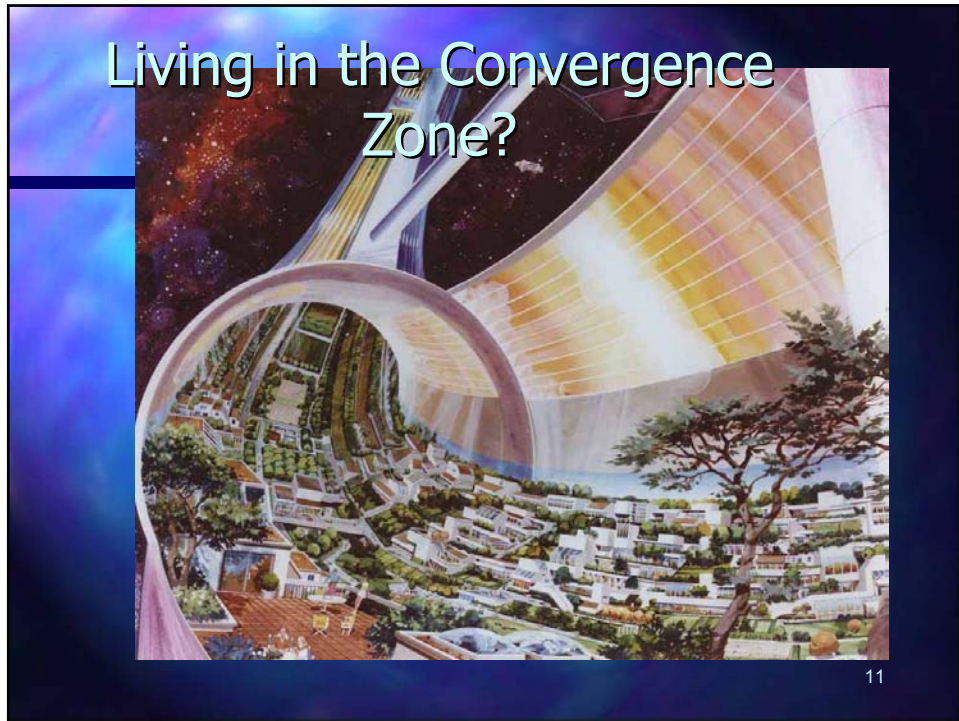
Regenerable Systems
Engineered Materials
Micro-systems
Automation
Biomimetics
Flexible Adaptive Architectures
Biomimetics
Micro-systems
Autonomy
Telepresence, VR
Robotic Systems

Bioregenerative Life Support

Engineered Support
Hybrid Systems
Genetic Engineering


Physical / Chemical Life Support

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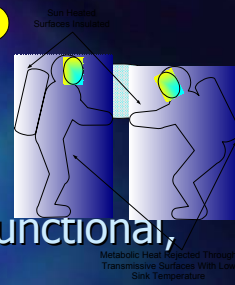
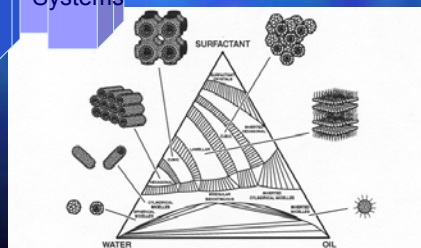
Someday Maybe - But

- For Our Design Horizon, Mission Resources Will Remain Scarce
 - Best case launch costs remain high
 - The sun isn't getting any brighter
- Systems Will Be Limited in Scale & Complexity
- Intensive, Engineered Systems Will Need to Match Some of the Biosphere's Best Tricks



Vision Statement

- Symbiotic, Biomimetic, Multi-functional, Modular Life Support



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Recommendation

- Increase research focus in the convergence zone
 - Opportunities for symbiosis & multi-functional units
 - Biomimetic materials and processes
 - Micro-reactors, MEMS
 - Systems integration elements
 - Distributed and adaptive control
 - Fluid and mechanical interfaces

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